

## IBM SAS 2.5-inch MLC Enterprise SSDs

### IBM Redbooks Product Guide

The IBM® SAS 2.5-inch MLC Enterprise solid-state drives (SSDs) for IBM System x® employ enterprise MLC NAND technology to provide an affordable, but performance-driven solution for applications requiring enterprise workloads with a mix of read/write operations. These industry standard 2.5-inch form factor SSDs use a single-chip controller with a SAS interface on the system side and 16 channels of NAND flash internally. They provide outstanding performance, endurance, reliability, and energy efficiency for random read- and write-intensive enterprise workloads such as databases, data warehouses, corporate email and collaboration, actively connected users, caching and tiering applications, and others.

Figure 1 shows the IBM SAS 2.5-inch MLC Enterprise SSD.



Figure 1. IBM SAS 2.5-inch MLC Enterprise SSD

### Did you know

With FlashGuard protection, IBM SAS MLC Enterprise SSDs can be fully rewritten up to ten times per day throughout their entire five-year life expectancy. Unlike SATA drives, the SAS interface supports full duplex data transfer for higher performance, as well as dual port connectivity and enterprise-level error recovery for better availability.

Rigorous testing of 2.5-inch Enterprise MLC SSDs by IBM through the ServerProven® program assures a high degree of confidence in storage subsystem compatibility and reliability. Providing additional peace of mind, these drives are covered under IBM warranty.

## Part number information

Table 1 lists the information for ordering part numbers and feature codes.

Table 1. Ordering part numbers and feature codes

Description	Part number	Feature code
IBM 200GB SAS 2.5" MLC HS Enterprise SSD	49Y6129	A3EW
IBM 200GB SAS 2.5" MLC SS Enterprise SSD	49Y6144	A3EX
IBM 400GB SAS 2.5" MLC HS Enterprise SSD	49Y6134	A3EY
IBM 400GB SAS 2.5" MLC SS Enterprise SSD	49Y6149	A3EZ
IBM 800GB SAS 2.5" MLC HS Enterprise SSD	49Y6139	A3F0
IBM 800GB SAS 2.5" MLC SS Enterprise SSD	49Y6154	A3F1

The part numbers include the following items:

- One SSD with a hot-swap or simple-swap drive tray
- Technical Update Flyer
- Warranty Flyer
- *Important Notices* document

## Features

- Industry standard 2.5-inch form factor supports 2.5-inch drive bays on selected System x, IBM iDataPlex®, IBM BladeCenter® and IBM Flex System™ servers
- Utilizes industry leading 24 nm MLC NAND technology
- Cost-effective MLC SAS drive with high read and write performance to fulfill client needs in the enterprise space
- High endurance, with up to 14.6 PB of total bytes written (TBW) to withstand applications with intensive read/write workloads
- Energy saving, with as little as 7 watt power consumption per drive
- Absence of moving parts to reduce potential failure points in the server
- S.M.A.R.T. support
- Advanced Encrypting Standard (AES) 256-bit encryption
- FlashGuard technology extends the native endurance of commercial-grade MLC flash
  - Aggregated Flash Management
  - Advanced Signal Processing
  - Enhanced Error Correction
- DataGuard technology protects against data corruption and loss
  - Full data path protection
  - Flexible Redundant Array of Memory Elements (F.R.A.M.E.) data recovery algorithm
- EverGuard technology protects data in the event of unplanned power outages
- Static wear leveling evenly distributes data across the drive
- Bad block management replaces failed blocks with new ones from the spare pool
- Thermal throttling to extend the life of the drive
- Data retention management to ensure availability and integrity of stored data
- Minimal write amplification for efficient flash utilization and extended lifetime

The key difference between Enterprise SSDs and Enterprise Value SSDs is their endurance (or life expectancy). SSDs have a huge but finite number of program/erase (P/E) cycles, which affects how long they can perform write operations and thus their life expectancy. Enterprise SSDs have significantly better endurance but higher cost/IOPS ratio compared to Enterprise Value SSDs. SSD write endurance is typically measured by the number of program/erase cycles that the drive can incur over its lifetime, listed as TBW in the device specification.

For example, with IBM 800GB SAS 2.5-inch MLC Enterprise SSD, the entire 800 GB can be fully re-written up to ten times per day (up to 8 TB writes per day) to meet the five-year lifetime expectation of the drive, while the Enterprise Value SSD can sustain up to only 40 GB writes per day (200 times less) to provide the same five-year lifetime.

## Technical specifications

Table 2 presents technical specifications for the IBM SAS MLC Enterprise solid-state drives.

Table 2. IBM SAS MLC Enterprise SSD technical specifications

Specification	200 GB		400 GB		800 GB	
Part number	49Y6129	49Y6144	49Y6134	49Y6149	49Y6139	49Y6154
Interface	6 Gbps SAS	6 Gbps SAS	6 Gbps SAS	6 Gbps SAS	6 Gbps SAS	6 Gbps SAS
Hot-swap drive	Yes	No	Yes	No	Yes	No
Form factor	2.5-inch	2.5-inch	2.5-inch	2.5-inch	2.5-inch	2.5-inch
Capacity	200 GB	200 GB	400 GB	400 GB	800 GB	800 GB
Endurance	5-year life time (3.65 PB TBW)	5-year life time (3.65 PB TBW)	5-year life time (7.3 PB TBW)	5-year life time (7.3 PB TBW)	5-year life time (14.6 PB TBW)	5-year life time (14.6 PB TBW)
Data reliability	< 1 in 10 <sup>17</sup> bits read	< 1 in 10 <sup>17</sup> bits read	< 1 in 10 <sup>17</sup> bits read	< 1 in 10 <sup>17</sup> bits read	< 1 in 10 <sup>17</sup> bits read	< 1 in 10 <sup>17</sup> bits read
MTBF, hours	> 2,500,000	> 2,500,000	> 2,500,000	> 2,500,000	> 2,500,000	> 2,500,000
IOPS read*	100,000	100,000	100,000	100,000	100,000	100,000
IOPS write*	50,000	50,000	50,000	50,000	50,000	50,000
Sequential read rate†	500 MBps	500 MBps	500 MBps	500 MBps	500 MBps	500 MBps
Sequential write rate†	500 MBps	500 MBps	500 MBps	500 MBps	500 MBps	500 MBps
Access time	< 0.1 ms	< 0.1 ms	< 0.1 ms	< 0.1 ms	< 0.1 ms	< 0.1 ms
Shock	1000 <i>g</i> , 0.5 ms	1000 <i>g</i> , 0.5 ms	1000 <i>g</i> , 0.5 ms	1000 <i>g</i> , 0.5 ms	1000 <i>g</i> , 0.5 ms	1000 <i>g</i> , 0.5 ms
Vibration, operating	1.0 <i>g</i> rms 5-300 Hz 0.5 <i>g</i> rms 300-400 Hz	1.0 <i>g</i> rms 5-300 Hz 0.5 <i>g</i> rms 300-400 Hz	1.0 <i>g</i> rms 5-300 Hz 0.5 <i>g</i> rms 300-400 Hz	1.0 <i>g</i> rms 5-300 Hz 0.5 <i>g</i> rms 300-400 Hz	1.0 <i>g</i> rms 5-300 Hz 0.5 <i>g</i> rms 300-400 Hz	1.0 <i>g</i> rms 5-300 Hz 0.5 <i>g</i> rms 300-400 Hz
Vibration, non-operating	3.0 <i>g</i> rms 5-200 Hz	3.0 <i>g</i> rms 5-200 Hz	3.0 <i>g</i> rms 5-200 Hz	3.0 <i>g</i> rms 5-200 Hz	3.0 <i>g</i> rms 5-200 Hz	3.0 <i>g</i> rms 5-200 Hz
Typical power	7 W	7 W	7 W	7 W	7 W	7 W

\* 4 KB block transfers

† 128 KB block transfers

The TBW value that is assigned to a solid-state device is the total bytes of written data that a drive can be guaranteed to complete. Reaching this limit does not cause the drive to immediately fail; the TBW simply denotes the maximum number of writes that can be guaranteed. A solid-state device will not fail upon reaching the specified TBW, but at some point after surpassing the TBW value (and based on manufacturing variance margins), the drive will reach the end-of-life point, at which time the drive will go into read-only mode. Because of such behavior, careful planning must be done to use SSDs in the application environments to ensure that the TBW of the drive will not be exceeded prior to the required life expectancy.

## Supported servers

The IBM SAS MLC Enterprise SSDs and supported RAID controllers can be installed in the System x and iDataPlex servers identified in Table 3 and the BladeCenter and Flex System servers identified in Table 4.

Table 3. Supported System x and iDataPlex servers

Part number	Product description	x3100 M4 (2582)	x3250 M4 (2583)	x3300 M4 (7382)	x3500 M4 (7383)	x3530 M4 (7160)	x3550 M4 (7914)	x3630 M4 (7158)	x3650 M4 (7915)	x3690 X5 (7147)	x3750 M4 (8722)	x3850 X5 (7143)	dx360 M4 (7912)
49Y6129	IBM 200GB SAS 2.5" MLC HS Enterprise SSD	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N
49Y6144	IBM 200GB SAS 2.5" MLC SS Enterprise SSD	N	Y	N	N	Y	N	N	N	N	N	N	Y
49Y6134	IBM 400GB SAS 2.5" MLC HS Enterprise SSD	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N
49Y6149	IBM 400GB SAS 2.5" MLC SS Enterprise SSD	N	Y	N	N	Y	N	N	N	N	N	N	Y
49Y6139	IBM 800GB SAS 2.5" MLC HS Enterprise SSD	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N
49Y6154	IBM 800GB SAS 2.5" MLC SS Enterprise SSD	N	Y	N	N	Y	N	N	N	N	N	N	Y

Table 4. Supported BladeCenter and Flex System servers

Part number	Product description	HS12 (8028)	HS22 (7870)	HS22V (7871)	HS23 (7875)	HS23E (8038)	HX5 (7873)	x220 (7906)	x240 (8737)	x440 (7917)
49Y6129	IBM 200GB SAS 2.5" MLC HS Enterprise SSD	N	Y	N	Y	Y	N	Y	Y	Y
49Y6144	IBM 200GB SAS 2.5" MLC SS Enterprise SSD	N	N	N	N	N	N	N	N	N
49Y6134	IBM 400GB SAS 2.5" MLC HS Enterprise SSD	N	Y	N	Y	Y	N	Y	Y	Y
49Y6149	IBM 400GB SAS 2.5" MLC SS Enterprise SSD	N	N	N	N	N	N	N	N	N
49Y6139	IBM 800GB SAS 2.5" MLC HS Enterprise SSD	N	Y	N	Y	Y	N	Y	Y	Y
49Y6154	IBM 800GB SAS 2.5" MLC SS Enterprise SSD	N	N	N	N	N	N	N	N	N

See the IBM ServerProven® website for the latest compatibility information for System x, BladeCenter, iDataPlex and Flex System servers: <http://ibm.com/servers/eserver/serverproven/compat/us/>

## Supported storage controllers

The IBM SAS MLC Enterprise SSDs require a supported disk controller. Tables 5 and 6 list the System x, BladeCenter, and Flex System controllers that support these SSDs installed in a supported server.

Table 5. RAID controllers for System x and iDataPlex servers supported with internal SSDs

Part number	Product description	x3100 M4 (2582)	x3250 M4 (2583)	x3300 M4 (7382)	x3500 M4 (7383)	x3530 M4 (7160)	x3550 M4 (7914)	x3630 M4 (7158)	x3650 M4 (7915)	x3690 X5 (7147)	x3750 M4 (8722)	x3850 X5 (7143)	dx360 M4 (7912)
Onboard	ServeRAID M5110e SAS/SATA Controller	N	N	N	N	N	N	N	Y	N	Y	N	N
81Y4481	ServeRAID M5110 SAS/SATA Controller	N	N	Y	Y	Y	Y	N	Y	N	Y	N	Y
81Y4448	ServeRAID M1115 SAS/SATA Controller	N	N	Y	Y	Y	Y	N	N	N	Y	N	Y
81Y4492	ServeRAID H1110 SAS/SATA Controller	Y	Y	Y	N	Y	Y	N	N	N	N	N	Y
90Y4304	ServeRAID M5016 SAS/SATA Controller	N	N	N	N	N	N	N	N	Y	N	Y	N
46M0829	ServeRAID M5015 SAS/SATA Controller	Y	Y	N	N	N	N	N	N	Y	N	Y	N
46M0916	ServeRAID M5014 SAS/SATA Controller	Y	Y	N	N	N	N	N	N	Y	N	Y	N
46M0831	ServeRAID M1015 SAS/SATA Controller	Y	Y	N	N	N	N	N	N	Y	N	Y	N
46M0969	ServeRAID B5015 SSD Controller	N	N	N	N	N	N	N	N	N	N	N	N
Onboard	ServeRAID C100 / C105	N	N	N	N	N	N	N	N	N	N	N	N
46M0912	IBM 6Gb Performance Optimized HBA	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y

Table 6. RAID controllers for BladeCenter and Flex System servers supported with internal SSDs

Part number	Product description	HS12 (8028)	HS22 (7870)	HS22V (7871)	HS23 (7875)	HS23E (8038)	HX5 (7873)	x220 (7906)	x240 (8737)	x440 (7917)
90Y4390	ServeRAID M5115 SAS/SATA Controller	N	N	N	N	N	N	Y	Y	Y
90Y4750	ServeRAID H1135 Controller	N	N	N	N	Y	N	Y	N	N
Onboard	ServeRAID C105	N	N	N	N	N	N	N	N	N
Onboard	Integrated LSI SAS2004	N	N	N	Y	N	N	N	Y	Y
46C7167	ServeRAID-MR10ie (CIOv) Controller	N	N	N	N	N	N	N	N	N
Onboard	Integrated LSI SAS1064e	N	Y	N	N	N	N	N	N	N
46M6908	SSD Expansion Card for IBM BladeCenter HX5	N	N	N	N	N	N	N	N	N

See the IBM ServerProven website for the latest information about the adapters supported by each System x server type: <http://ibm.com/servers/eserver/serverproven/compat/us/>

## Supported operating systems

Solid-state drives operate transparently to users, storage systems, applications, databases, and operating systems. The controllers that support SSDs are supported by the following operating systems:

- Microsoft Windows Server 2012
- Microsoft Windows Server 2008 R2
- Microsoft Windows Server 2008, Datacenter x64 Edition
- Microsoft Windows Server 2008, Datacenter x86 Edition
- Microsoft Windows Server 2008, Enterprise x64 Edition
- Microsoft Windows Server 2008, Enterprise x86 Edition
- Microsoft Windows Server 2008, Standard x64 Edition
- Microsoft Windows Server 2008, Standard x86 Edition
- Microsoft Windows Server 2008, Web x64 Edition
- Microsoft Windows Server 2008, Web x86 Edition
- Microsoft Windows Server 2008 Foundation
- Microsoft Windows Server 2008 HPC Edition
- Microsoft Windows HPC Server 2008
- Microsoft Windows Small Business Server 2008 Premium Edition
- Microsoft Windows Small Business Server 2008 Standard Edition
- Microsoft Windows Essential Business Server 2008 Premium Edition
- Microsoft Windows Essential Business Server 2008 Standard Edition
- Red Hat Enterprise Linux 6 Server Edition
- Red Hat Enterprise Linux 6 Server x64 Edition
- Red Hat Enterprise Linux 5 Server Edition
- Red Hat Enterprise Linux 5 Server Edition with Xen
- Red Hat Enterprise Linux 5 Server with Xen x64 Edition
- Red Hat Enterprise Linux 5 Server x64 Edition
- Red Hat Enterprise Linux 4 AS for AMD64/EM64T
- Red Hat Enterprise Linux 4 AS for x86
- SUSE LINUX Enterprise Server 11 for AMD64/EM64T
- SUSE LINUX Enterprise Server 11 for x86
- SUSE LINUX Enterprise Server 11 with Xen for AMD64/EM64T
- SUSE LINUX Enterprise Server 10 for AMD64/EM64T
- SUSE LINUX Enterprise Server 10 for x86
- SUSE LINUX Enterprise Server 10 with Xen for AMD64/EM64T
- SUSE LINUX Enterprise Server 10 with Xen for x86
- VMware vSphere 5.1
- VMware vSphere 5.0
- VMware ESX 4.0
- VMware ESX 4.1
- VMware ESXi 4.0
- VMware ESXi 4.1

See the IBM ServerProven website for the latest information about the specific versions and service packs supported: <http://ibm.com/servers/eserver/serverproven/compat/us/>. Click **System x servers**, then **Disk controllers** to see the support matrix. Click the check mark that is associated with the System x server in question to see the details about operating system support.

## Warranty

The IBM SAS 2.5-inch MLC Enterprise SSDs carry a 1-year, customer-replaceable unit (CRU) limited warranty. When installed in a System x server, these drives assume your system's base warranty and any IBM ServicePac® upgrade.

## Physical specifications

The IBM SAS 2.5-inch MLC Enterprise SSDs have the following physical specifications.

Dimensions and weight (approximate):

- Height: 9.5 mm (0.4 in.)
- Width: 70 mm (2.8 in.)
- Depth: 100 mm (3.9 in.)
- Weight: 122 g (0.3 lb)

Shipping dimensions and weight (approximate):

- Height: 63 mm (2.5 in.)
- Width: 174 mm (6.9 in.)
- Depth: 133 mm (5.2 in.)
- Weight: 448 g (1.0 lb)

## Operating environment

The IBM SAS 2.5-inch MLC Enterprise SSDs are supported in the following environment:

- Temperature: 0 - 70 °C (32 - 158°F)
- Relative humidity: 8 - 85% (noncondensing)
- Maximum altitude: 3,050 m (10,000 ft)

## Agency approvals

The IBM SAS 2.5-inch MLC Enterprise SSDs have the following agency approvals:

- UL
- CSA
- TUV
- FCC
- EMC
- CE Mark
- C-Tick Mark
- Taiwan (BSMI Certification)
- Korea EMI



## Related publications

For more information, see the following documents:

- IBM US Announcement Letter IBM SAS 2.5-inch MLC Enterprise SSDs  
<http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS113-024>
- IBM Redbooks® ServeRAID Adapter Quick Reference  
<http://www.redbooks.ibm.com/abstracts/tips0054.html?Open>
- *IBM System x Configuration and Options Guide*  
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- IBM ServerProven  
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This document was created or updated on March 12, 2013.

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